16. (New) A computer program stored on a machine readable medium which is arranged to implement a method of migrating subscriber data associated with a plurality of subscriber identities from a first Home Location Register (HLR) node to a second HLR node, said HLR nodes being connected by a fixed network, for each subscriber data associated with a subscriber identity or a small group of subscriber identities to be migrated from said first HLR node to said second HLR node, the method comprises the steps of:

A. at said first HLR node, changing a state of said subscriber data from active to standby;

B. copying from said first HLR node said subscriber data associated with said subscriber identity or said small group of subscriber identities to said second HLR node; and

C. at said second HLR node, changing the state of said subscriber data from standby to active.

REMARKS

The Examiner's reconsideration of the application is requested in view of the amendments above and further comments which follow below.

In the previous response, only claim 1 was amended, and new claims 11 and 12 were added. In the present amendment, claim 1 has been further amended, claims 2 -5 have been amended, claim 6 has been cancelled, claims 11 and 12 have been amended, and new claims 13 – 16 have been added to the application.

The present invention generally relates to the use of Home Location Register (HLR) nodes to support subscribers in a mobile cellular communications system. The invention relates to methods of migrating subscriber data associated with subscriber identities between HLR nodes. In this regard, the invention comprises three methods relating to the migration of data.

In a first method, the migration of subscriber data is between two HLR nodes which are arranged in a mated pair configuration. That is, that each of the HLR nodes contains the subscriber data relating to the plurality of subscriber identities that the two HLR nodes between them support. Each HLR node is arranged to support approximately half (in the preferred embodiment) of the subscriber data and this subscriber data has a state of active in that node. The remaining subscriber data in that node has a state of standby. As such, the node configured in this way is able to complete transactions such as the connection of calls for those subscriber identities whose data in that node has a state of active but is unable to complete such transactions for those subscriber identities that have a state of standby in that node. In the case where this node receives a transaction request from a subscriber whose subscriber data has a state of standby then the node conveys the transaction request to the other node of the mated pair configuration. The other HLR node of the mated pair configuration is configured to support those subscribers whose subscriber data has a state of standby in the first node. For these subscribers, their data has a state of active in the second node. It can therefore be seen that between them the two nodes support all subscribers in a load sharing type arrangement. It should also be noted that for those subscribers whose data has a state of active in the first node, the data for these subscribers is given a state of standby in the second node.

In the case where it is wished to change the balance of load sharing between the two HLR nodes, i.e. where it is wished to migrate some of the subscriber data associated with one or more of the subscriber identities supported by, say, the first node, it is not actually necessary to transfer or copy from the first node to the second node the subscriber data to be migrated since this data already exists in the second node, albeit having a state of standby. Therefore, to effect the migration of subscriber data for a subscriber identity, it is only necessary that at the first node the state of said subscriber data is changed from active to standby and then at the second node "transfer" of the subscriber data from the first node to the second node is effected by changing the state of that subscriber data in the second node from standby to active. The "transfer" of data is therefore effected, not by an actual transmission of data from one node to the other,

but by means of coordinating the change of state of that data in the first node from active to standby followed by changing its state from standby to active in the second node.

It will be appreciated that at all times all subscriber data, save for the subscriber data relating to the subscriber identity being migrated, is still available for the completion of subscriber transactions (connection of calls, for example) by the relevant HLR node. The advantage of this method over prior art methods is that only the subscriber data being migrated is, for a short time, not accessible for completion of subscriber transactions while the migration occurs. This contrasts with prior art methods where the migration of subscriber data requires one or other of the nodes to be placed in standby mode, thus disabling all subscriber data for the period that subscriber data migration takes place. In addition to "load sharing" the support of subscribers, the mated pair arrangement of the preferred embodiment of the invention provides also the ability to address the problem encountered when an HLR node fails. In such a case, when one of the HLR nodes fails, approximately half of subscribers will see no impact on service since they are currently being supported by the other (not failed) node. For those subscribers supported by the failed node, there will be a disruption in service while the functioning HLR node changes the state of its standby subscriber data from standby to active, i.e. while said functioning node takes on responsibility for supporting the active subscribers of the failed node.

The other two methods of the invention relate to the migration of subscriber data from one HLR node to the other when a failed node is fixed to function properly again. In such a situation, the functioning node is supporting all subscribers, i.e. all subscriber data has a state of active. The newly functioning node no longer has current subscriber data that allows it to support its share of subscribers. In a first method of re-establishing load sharing of the mated pair HLR node configuration, it is firstly necessary to copy from the first (functioning) HLR node all subscriber data associated with the plurality of subscriber identities of the communication network to the second (now fixed) HLR node. At this point in time, all subscriber data in the first node has a state of active. The subscriber data copied to the second node will initially be provided with a state of

standby. Consequently, even once the step of copying all data from the first node to the second node is completed, the first node will continue to service all subscribers. In order to re-establish the load sharing arrangement, for each subscriber identity that is to be supported by the second node, i.e. for each subscriber identity whose data is to be migrated from the first node to the second node, the method is as before. That is that in the first node the subscriber data associated with that subscriber identity has its state changed from active to standby and then in the second node has its state changed from standby to active. By repeating this process for each subscriber data associated with each subscriber identity or each small group of subscriber identities to be supported by the second node, it is possible to re-establish the load sharing arrangement between the two nodes while at the same time only ever preventing for a short time, while data migration is occurring, the service to the subscriber(s) whose data is being migrated. In other words, as in the first method of the invention, it is not necessary to place the first node on standby while subscriber data is being migrated from it to the second node in order to re-establish the load sharing arrangement.

In the third method of the invention, which is a second method of recovering from a node failure, rather than as a first step copying all subscriber data relating to the plurality of subscriber identities from the first node to the second node, the method comprises for each subscriber data associated with a subscriber identity or each small group of subscriber identities to be supported by the second node, at the first node changing the state of that subscriber's data from active to standby, then copying from the first node to the second node that subscriber data and at the second node, once the copying of the data is complete, changing the state of the subscriber data now in the second node from standby to active. This is done for each subscriber data associated with a subscriber identity or each small group of subscriber identities that is to be migrated to the second node to be supported by it. Once again, it is only that subscriber data that is in the process of being migrated, that is denied service for the period of data migration. Other subscribers continue to be supported by the mated pair HLR node configuration. It is not necessary to place either of the HLR nodes on standby.

The claims of the application have been amended in order to more fully define the various methods of the present invention, and to more clearly distinguish the present invention over the prior art relied on by the Examiner. The Examiner has rejected various of the presently pending claims under 35 U.S.C. § 102 as being anticipated by Houde or Ericsson. However, a better appreciation of these prior art references will reveal that they do not anticipate the present invention, nor render it obvious.

Referring firstly to Houde, it is clear that there is no teaching of migrating data as proposed by any of the three methods as now claimed for the present application. It can be seen from Houde, column 6, line 66 to column 7, line 14, that the master HLR platform 32 must be disconnected from the transfer points 38 and 40 in the event of recovering from failure of said master HLR platform in order to enable stored back-up data to be loaded on said platform and for active data to be migrated from the slave platform to said master HLR platform. As such, and as recognized by the Examiner in section 1 of the Office Action, the master HLR platform as a whole must be placed in a standby mode, i.e. non-operational mode. This is quite distinct from the present invention in which it is only a small amount of subscriber data that is effectively held in standby mode for the duration of data migration, rather than the whole node/platform. There is no motivation provided by the teaching of Houde to modify it in a manner which would result in the methods of the present invention.

With respect to Ericsson, similar observations can be made but, in particular, it should be noted that Ericsson addresses the problem of which HLR node to store the subscriber data of a subscriber in a complex UMTS system based on the location of the subscriber as determined by the system. In this case, while subscriber data for a subscriber identity can be said to be transferred from one HLR node to another, it is quite clear that this does not relate to any load sharing or failure mechanism where the nodes cooperate by holding active subscriber data of one node in standby mode in the other node. Once again, the Examiner also acknowledges in section 2 of the Office Action that Ericsson teaches that where subscriber data is migrated from one HLR node to another, that the first HLR node would be in standby mode.

In view of the foregoing, it is submitted that the application, as now presently claimed, distinguishes from the references, whether considered alone or in combination of their teachings. Reconsideration and allowance of the application is therefore urged.

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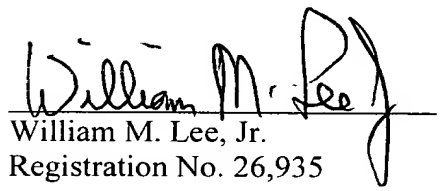
Respectfully submitted,



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Version With Markings To Show Changes Made

1. (Twice amended) A method of migrating [active] subscriber data associated with a plurality of subscriber identities from a first Home Location Register (HLR) node to a second HLR node, said HLR nodes being arranged such that subscriber data is distributed between said nodes, each node supporting some subscriber data as active data and some subscriber data as standby data, said standby data of one node corresponding to some active subscriber data of the other node, said [HLR] nodes being connected by a fixed network, wherein, for each subscriber data associated with a subscriber identity or a small group of subscriber identities to be migrated from said first HLR node to said second HLR node, the method [comprising]comprises the steps of:

[sequentially for each subscriber identity to be migrated, changing the state of active subscriber data associated with said subscriber identity from active to standby, transferring said data to said second node whereupon its state is changed to active.]

A. at said first HLR node, changing a state of said subscriber data from active to standby; and

B. transferring said subscriber data from said first HLR node to said second HLR node by way of changing at said second HLR node the state of the subscriber data from standby to active.

2. (Amended) A method as claimed in [claim 1] any one of claims 1, 13 or 14, comprising the further step of:

implementing a diversion function such that any of a subscriber data update and a subscriber request transaction[s] addressed for a subscriber identity arriving at one said node where the subscriber data is not active [are]is forwarded to the other node.

3. (Amended) A method as claimed in claim 2 wherein the diversion function is implemented such that any one of a subscriber data update and a subscriber request transaction[s] addressed for a subscriber identity arriving at said second node [are]is diverted to said first node if said subscriber identity and associated subscriber data is not active in said second node;

and wherein any one of a subscriber data update and a subscriber request transaction[s] addressed for said first node [are]is re-routed by said network to said second node.

4. (Amended) A method as claimed in claim 2 when dependent on claims 1 and 14 wherein said transfer comprises:

changing the state of said subscriber data in said first HLR from active;
copying said subscriber data from said first to said second HLR;
deleting said subscriber data from said first HLR; and
changing the state of said subscriber data in said second HLR to active.

5. (Amended) A method as claimed in claim 1 wherein said HLR nodes are arranged into a mated pair such that said active subscriber data is distributed across said nodes and wherein each node comprises a diversion function such that any of a subscriber data update and a subscriber request transaction[s] addressed for a subscriber identity arriving at one said HLR node where the subscriber data is not active [are]is forwarded to the other said HLR node.

11. (Amended) A computer program stored on a machine readable medium which is arranged to implement [a method of migrating active subscriber data associated with a plurality of subscriber identities from a first Home Location Register (HLR) node to a second HLR node, said HLR nodes being connected by a fixed network, the method comprising the steps of:

sequentially for each subscriber identity to be migrated, changing the state of active subscriber associated with said subscriber identity from active to standby, transferring said data to said second node whereupon its state is changed to active.]
a method of migrating subscriber data associated with a plurality of subscriber identities from a first Home Location Register (HLR) node to a second HLR node, said HLR nodes being arranged such that subscriber data is distributed between said nodes, each node supporting some subscriber data as active data and some subscriber data as standby data, said standby data of one node corresponding to some active subscriber data of the other node, said nodes being connected by a fixed network, wherein, for each subscriber data associated with a subscriber identity or a small group of subscriber identities to be migrated from said first HLR node to said second HLR node, the method comprises the steps of:

A. at said first HLR node, changing a state of said subscriber data from active to standby; and

B. transferring said subscriber data from said first HLR node to said second HLR node by way of changing at said second HLR node the state of the subscriber data from standby to active.

12. (Amended) A computer program implemented method as claimed in [claim 11]any one of claims 11, 15 or 16 further comprising the [further] step of:

implementing a diversion function such that any one of a subscriber data update and a subscriber request transaction[s] addressed for a subscriber identity arriving at one said node where the subscriber data is not active [are]is forwarded to the other node.